An engineered cell-laden adhesive hydrogel promotes craniofacial bone tissue regeneration in rats.

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Public Summary:
Cell-laden hydrogels are widely used in tissue engineering and regenerative medicine. However, many of these hydrogels are not optimized for use in the oral environment, where they are exposed to blood and saliva. To address these challenges, we engineered an alginate-based adhesive, photocrosslinkable, and osteoconductive hydrogel biomaterial (AdhHG) with tunable mechanical properties. The engineered hydrogel was used as an injectable mesenchymal stem cell (MSC) delivery vehicle for craniofacial bone tissue engineering applications. Subcutaneous implantation in mice confirmed the biodegradability, biocompatibility, and osteoconductivity of the hydrogel. In a well-established rat peri-implantitis model, application of the adhesive hydrogel encapsulating gingival mesenchymal stem cells (GMSCs) resulted in complete bone regeneration around ailing dental implants with peri-implant bone loss. Together, we have developed a distinct bioinspired adhesive hydrogel with tunable mechanical properties and biodegradability that effectively delivers patient-derived dental-derived MSCs. The hydrogel is photocrosslinkable and, due to the presence of MSC aggregates and hydroxyapatite microparticles, promotes bone regeneration for craniofacial tissue engineering applications.

Scientific Abstract:
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